MULTIMEDIA UNIVERSITY

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FINAL EXAMINATION

TRIMESTER 3, 2021/2022 (2130)

PEM0046 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Engineering)

9 AUGUST 2022
9.00 a.m. - 11.00 a.m.
(2 Hours)

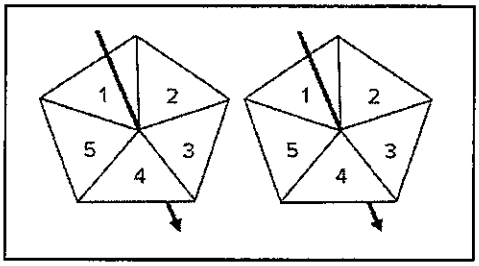
INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **FIVE** printed pages including the cover page.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working steps **MUST** be shown.
4. Statistical table is provided.

Answer ALL questions [100 marks].

QUESTION 1 [25 marks]

a. The diagram below shows two spinners that used in a game.



Calvin spins two spinners number 1 to 5 one after another. He records the sum of the values each spinner lands on.

i. Construct the probability distribution for the sum of the values each spinner lands on. Present your answers in tabular form. [6 marks]

ii. Find the probability that the sum is 8 or more. [1 mark]

iii. Find the expected value and the standard deviation for the sum of the values each spinner lands on. [4 marks]

b. The lower value of fuel consumption by vehicles has shown that high savings occur. If the fuel consumption, X, of a logistic company, measured in the unit of 1000 liters per week has a distribution of the form

$$f(x)=\begin{cases} ax+bx^2, & ,0<x\leq 1 \\ 0 & ,elsewhere \end{cases}$$

Given that the mean of X, $E(X)$ is 0.6, find

i. the values of the constant a and b. [8 marks]

ii. $P(X<0.5)$. [2 marks]

iii. the variance of X. [4 marks]

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QUESTION 2 [25 marks]

a. Essentially anyone who has a phone number can get telemarketing calls. It is known that the probability of telemarketing representative making a sale on a call is 0.15. If a random sample of 20 calls are made, find the probability that

i. more than three sales are made. [2 marks]

ii. at least six sales are made. [2 marks]

iii. between eleven to fifteen sales **unmade**. [3 marks]

iv. Find the mean and standard deviation for the number of sales made. [2 marks]

If a telemarketing representative required to achieve a mean of at least five sales each day,

v. finds the least number of calls each day a representative should make to achieve this target. [2 marks]

b. The number of surface defects in 10-meter square (m^2) of floor covering is 4.

i. Find the probability that no more than two defects in 10 m^2 floor covering. [1 mark]

ii. Find the probability that exactly four defects in $2.21m \times 3.0m$ floor covering. [3 marks]

iii. Find the probability that 5 pieces of floor covering each is $2.5m \times 2.0m$ will have at least ten defects. [3 marks]

c. A lecturer is interested in determining the performance of her students in introductory statistics course. Rather than examine the records of all students, she gives a test to her students in her class. The scores are normally distributed with a mean of 73 marks and a standard deviation of 8 marks. What is the probability that a randomly selected student scored

i. between 70 and 85 marks? [3 marks]

ii. more than the population mean by at least 15 marks? [2 marks]

iii. Marina is planning to take this test soon, what should her score be so that only 10% of all examinees score higher than she does? [2 marks]

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QUESTION 3 [25 marks]

a. Smartech Printing Shop has 5 employees (population). The hourly earnings (in Ringgit Malaysia) of each employee is given below

2 4 6 8 4

Consider all possible samples of **size three** which can be drawn without replacement from this population.

i. Find the mean and the standard deviation of the population. [3 marks]

ii. List all the possible samples of size three (without replacement) from this data and calculate the sample mean for each of these samples. (Leave the values of sample mean in 2 decimal places). [4 marks]

iii. Construct a sampling distribution of the sample mean. [3 marks]

iv. If a random sample of 3 members: 2, 4, 6 was mistakenly recorded as 2, 4, 9 calculate the non-sampling error. [2 marks]

b. According to a production senior engineer, the mean time spent (in hours) on engineering research by all engineers in his factory is 40 hours and a standard deviation of 5 hours. Consider a random sample of 64 engineers is chosen, find the probability

i. that the sample mean will be at most 42 hours. [2 marks]

ii. that the sample mean will be within the population mean by 0.5 hour. [3 marks]

iii. that the sample mean will be more than the population mean by at least 1 hour. [3 marks]

iv. that the sample mean will differ from population mean by 0.7 hour or more. [5 marks]

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QUESTION 4 [25 marks]

The marketing manager for a chain of hardware stores needed more information about the effectiveness of its advertising expenditures. A survey was conducted by a statistical consultant hired by the stores to determine the relation between monthly advertising expenditures, x and the sales volume, y. The following data were collected in 8 months

x (in hundred thousand)	40	20	50	25	25	20	40	50
y (in hundred thousand)	440	400	510	450	395	365	525	550

a. Find the equation of the least square regression line to predict monthly sales from advertising expenditures. [13 marks]

b. Plot the scatter diagram on the graph paper provided and draw the least square regression line on the same graph.

Describe the relationship between the two variables. [5 marks]

c. Estimate the sales volume if the advertising expenditure is 35 (in hundred thousand). [2 marks]

d. Calculate the linear correlation coefficient and give your comment on the value obtained. [5 marks]

(Note: For Question 4, leave all your answers in 3 decimal places)

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